

## DISPLAY CONTROLLER

### CHARACTERISTICS

The display controller handles transfers between the main memory and the CRT. The CRT is a standard 875 line raster-scanned TV monitor, refreshed at 60 fields per second from a bit map in main memory. The CRT contains 606 points horizontally, and 808 points vertically, or 489,648 points total.

The basic way in which information is presented on the display is by fetching a series of words from Alto main memory, and serially extracting bits to become the video signal. Therefore, 38 16-bit words are required to represent each scan line; 30,704 words are required to fill the screen.

### HARDWARE

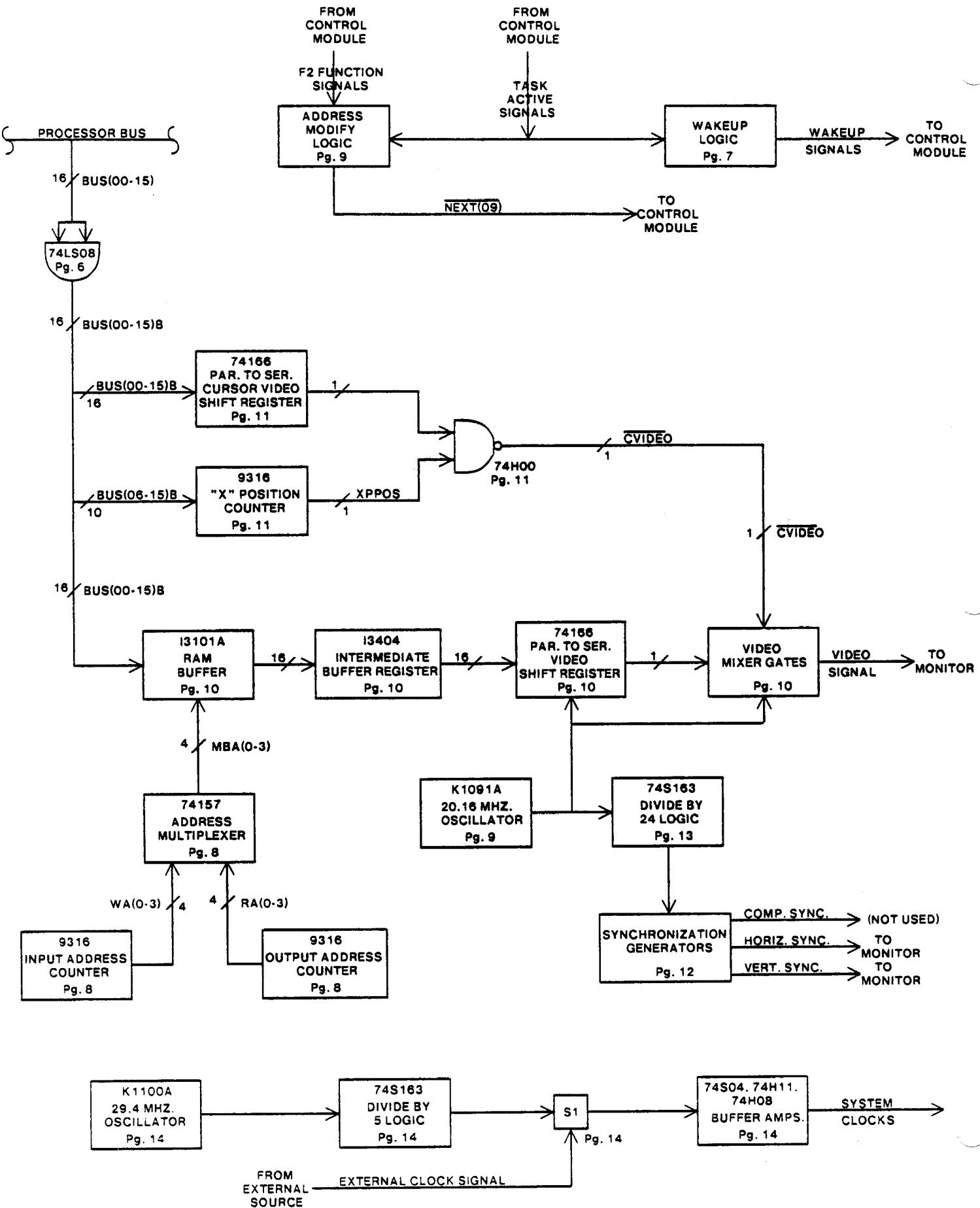
The display controller consists of a sync generator, a data buffer and serializing shift register, and three microcode tasks which control data handling and communicate with the Alto program. The Ram buffer is loaded from the Alto bus for the display word task DWT. The purpose of the intermediate buffer is to synchronize data transfers between the main buffer, which is synchronous with the 170 nsec. master clock, and the shift register, which is clocked with an asynchronous bit clock. The sync generator provides this clock and the vertical and horizontal synchronization signals required by the monitor.

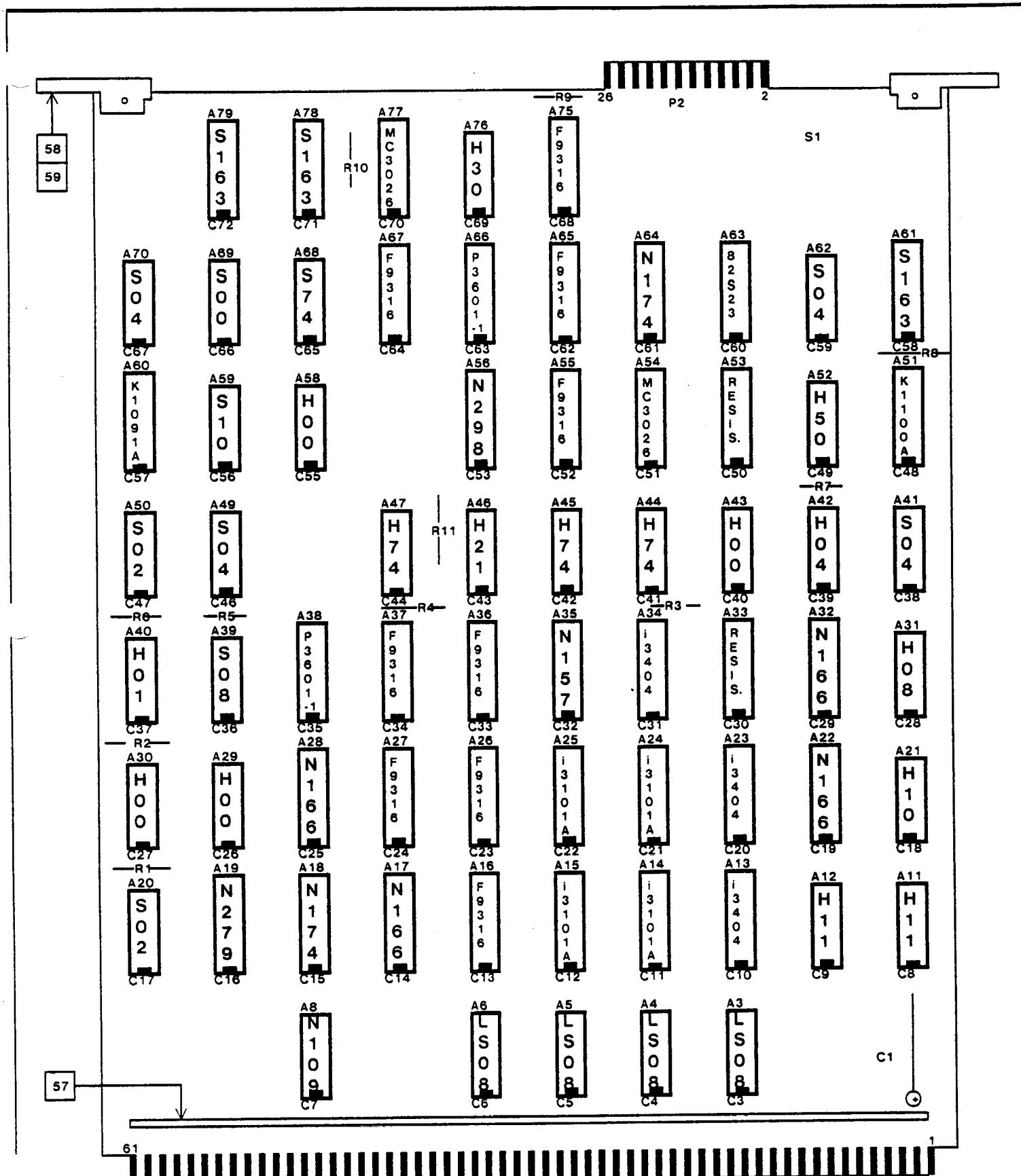
### CURSOR

Because of the difficulty of inserting a cursor at the appropriate place in the display bit map at reasonable speed, a hardware cursor is included in the Alto. The cursor consists of an arbitrary 16 by 16 bit patch, which is merged with the video at the appropriate time. The coordinate origin for the cursor is the upper left hand corner of the screen. The cursor presentation is unaffected by changes in display resolution.

The cursor hardware consists of a 16-bit shift register which holds the information to be displayed on the current scan line, and a counter which is incremented by the bit clock, and determines the x coordinate and bit map segment from the R memory into the hardware.

# DISPLAY CONTROL MODULE





PROPRIETARY NOTE ON SHEET 1 APPLIES TO ALL SHEETS

FILE: DISPLAY.SIL-3

TITLE

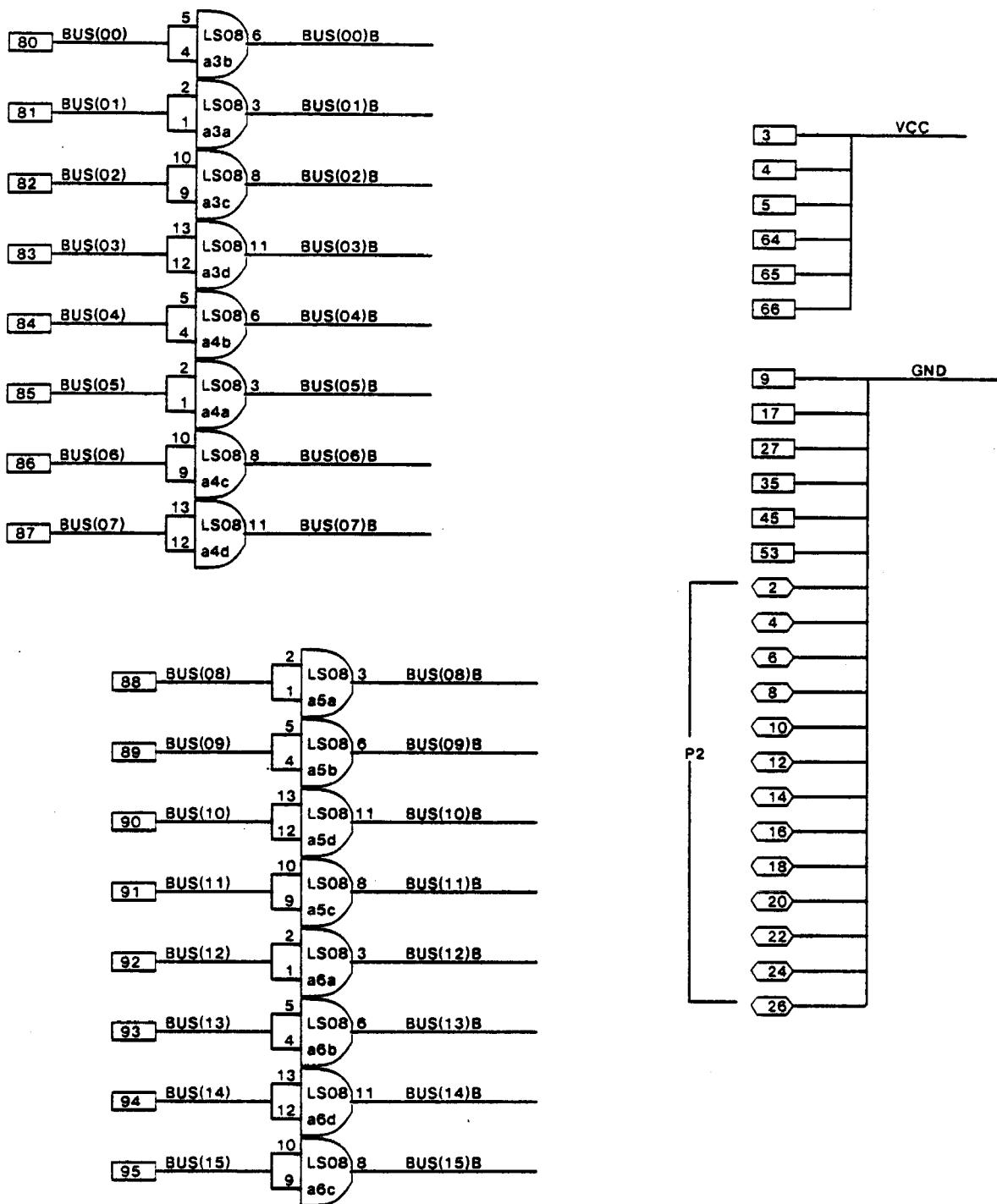
ASSEMBLY, PRINTED WIRING  
DISPLAY CONTROL MODULE

DWG.  
SIZE  
A41

DWG. 216339  
NO.

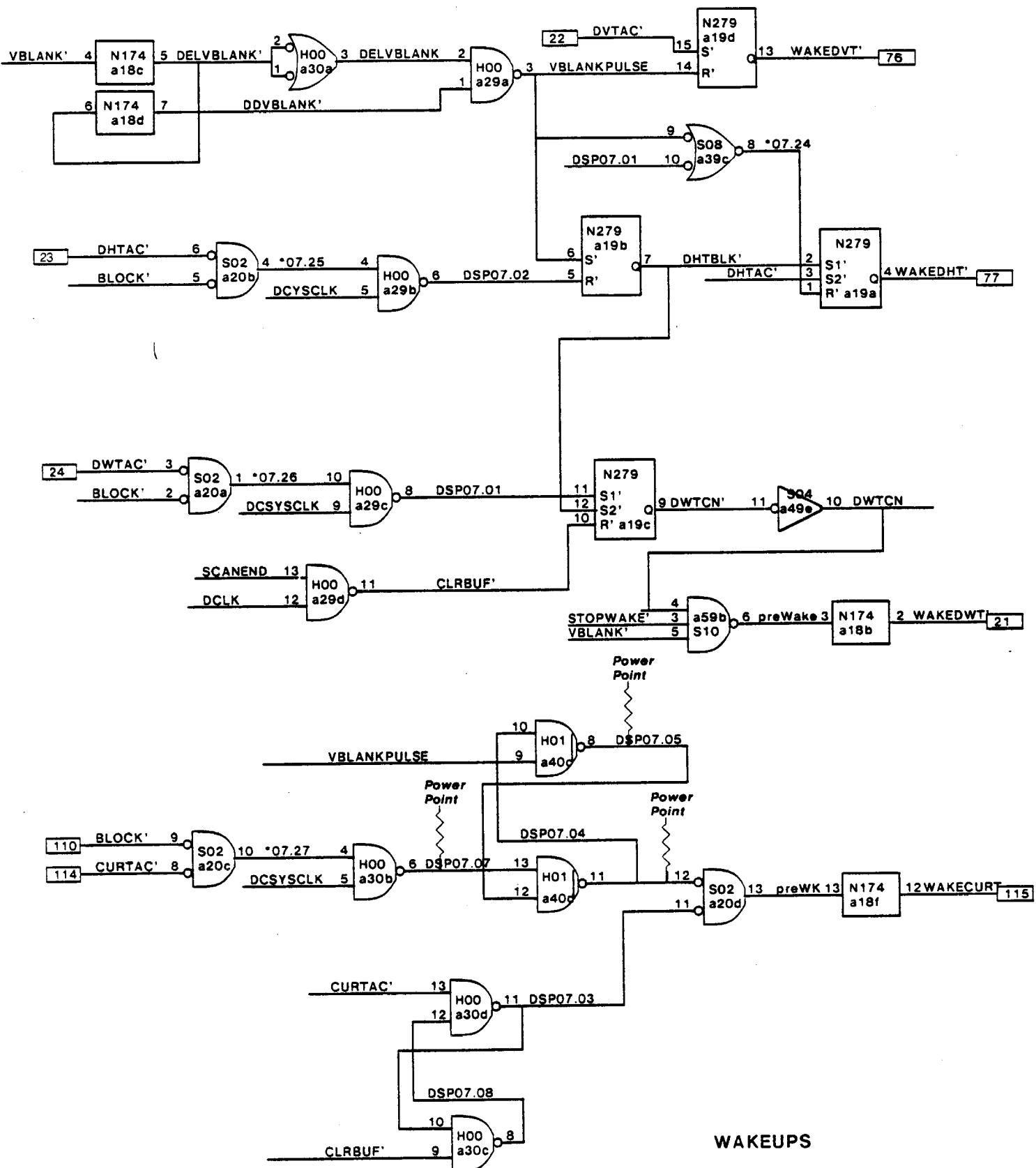
SHEET 3 OF 14

SHEET  
REV.  
G

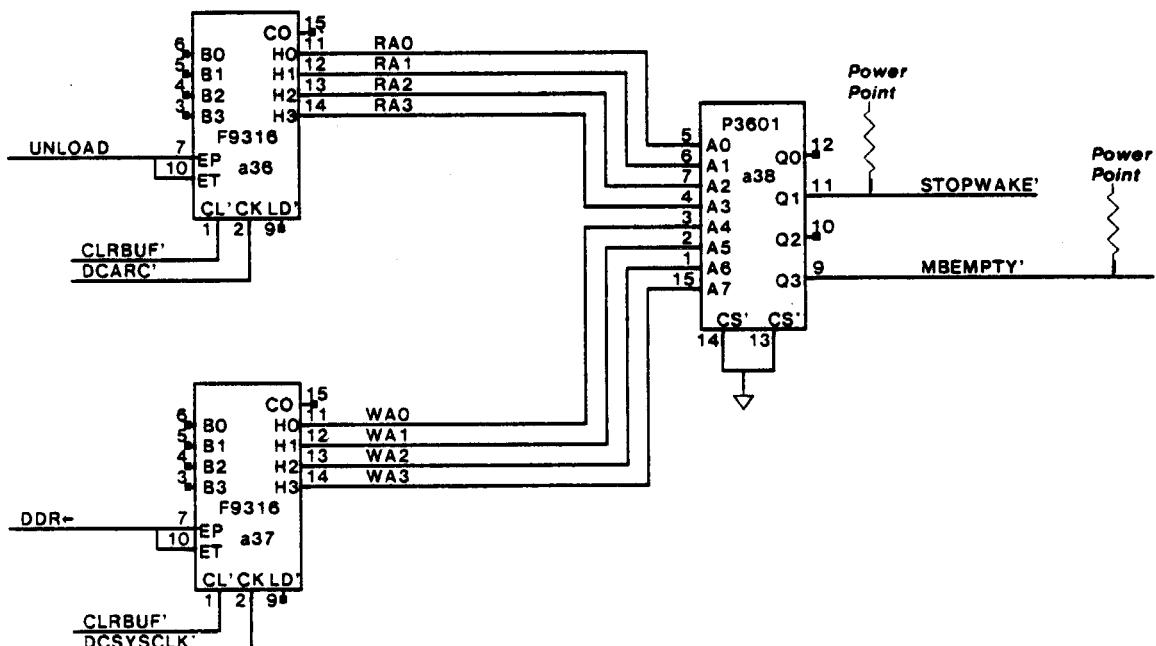
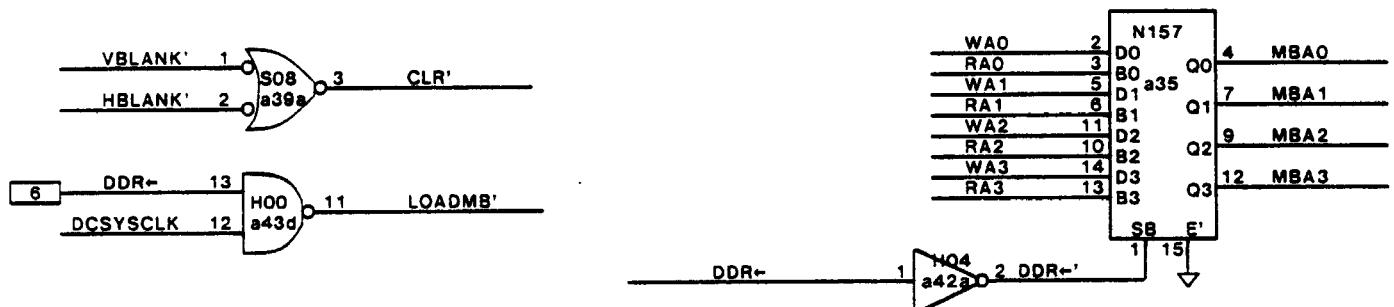
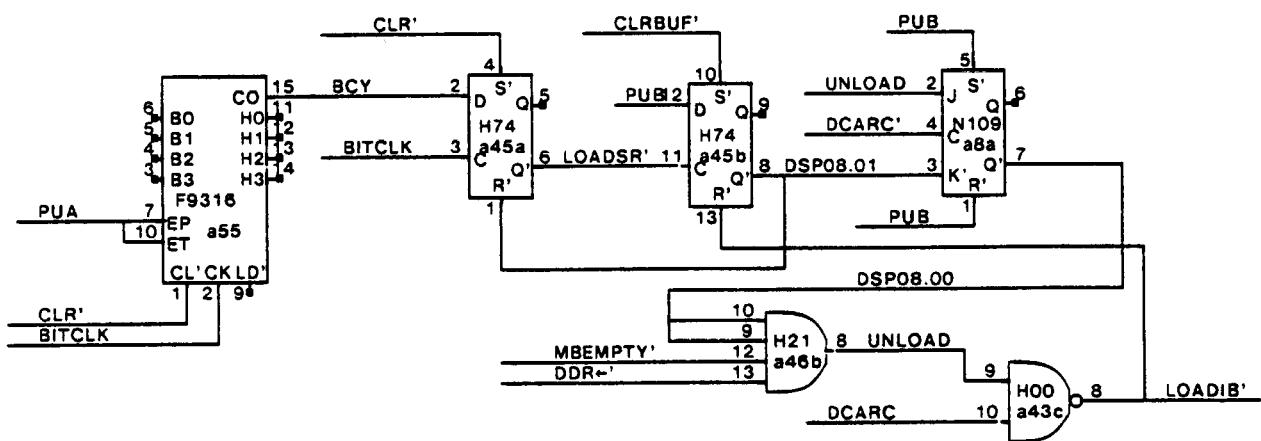


## **Bus Buffers**

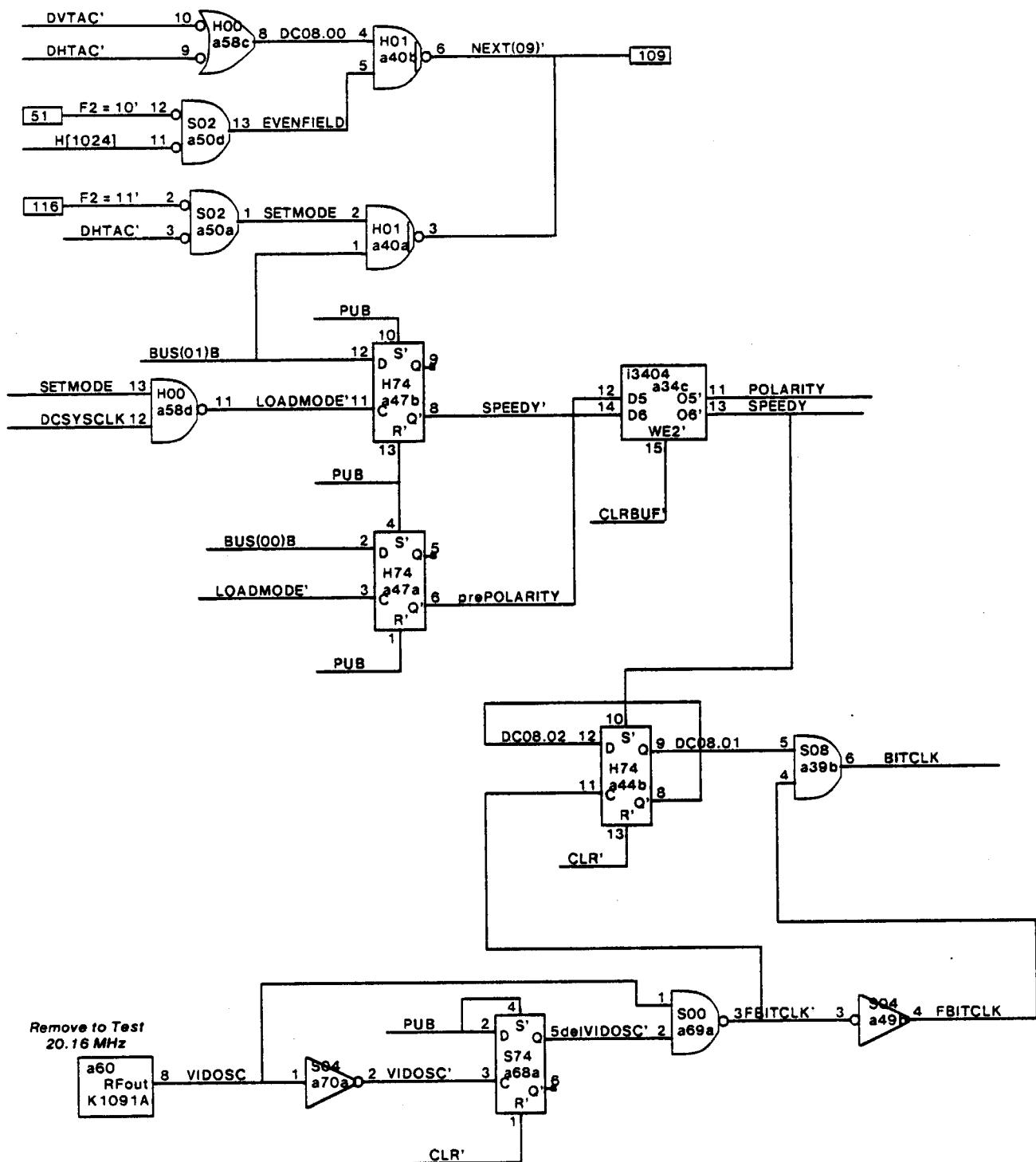
XEROX SPG	Project ALTO2	ASSEMBLY, P.W.- DISPLAY CONTROL	File DISPLAY.SIL-6	Designer FREEMAN	Rev G	Date 11/7/80	Page 6
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XEROX SPG	Project ALTO2	ASSEMBLY, P.W. DISPLAY CONTROL	File DISPLAY.SIL-7	Designer FREEMAN	Rev G	Date 11/11/80	Page 7
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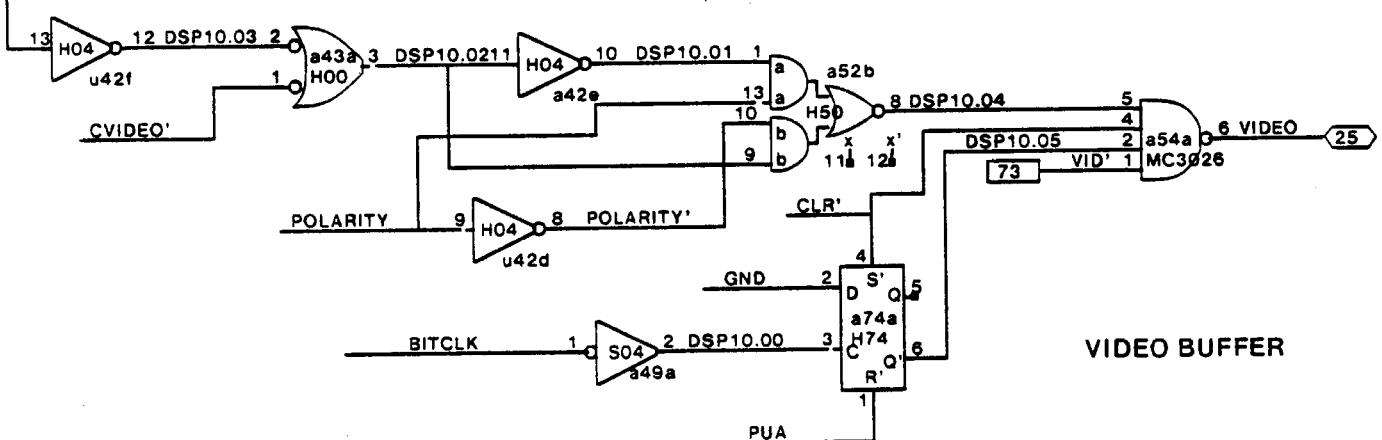
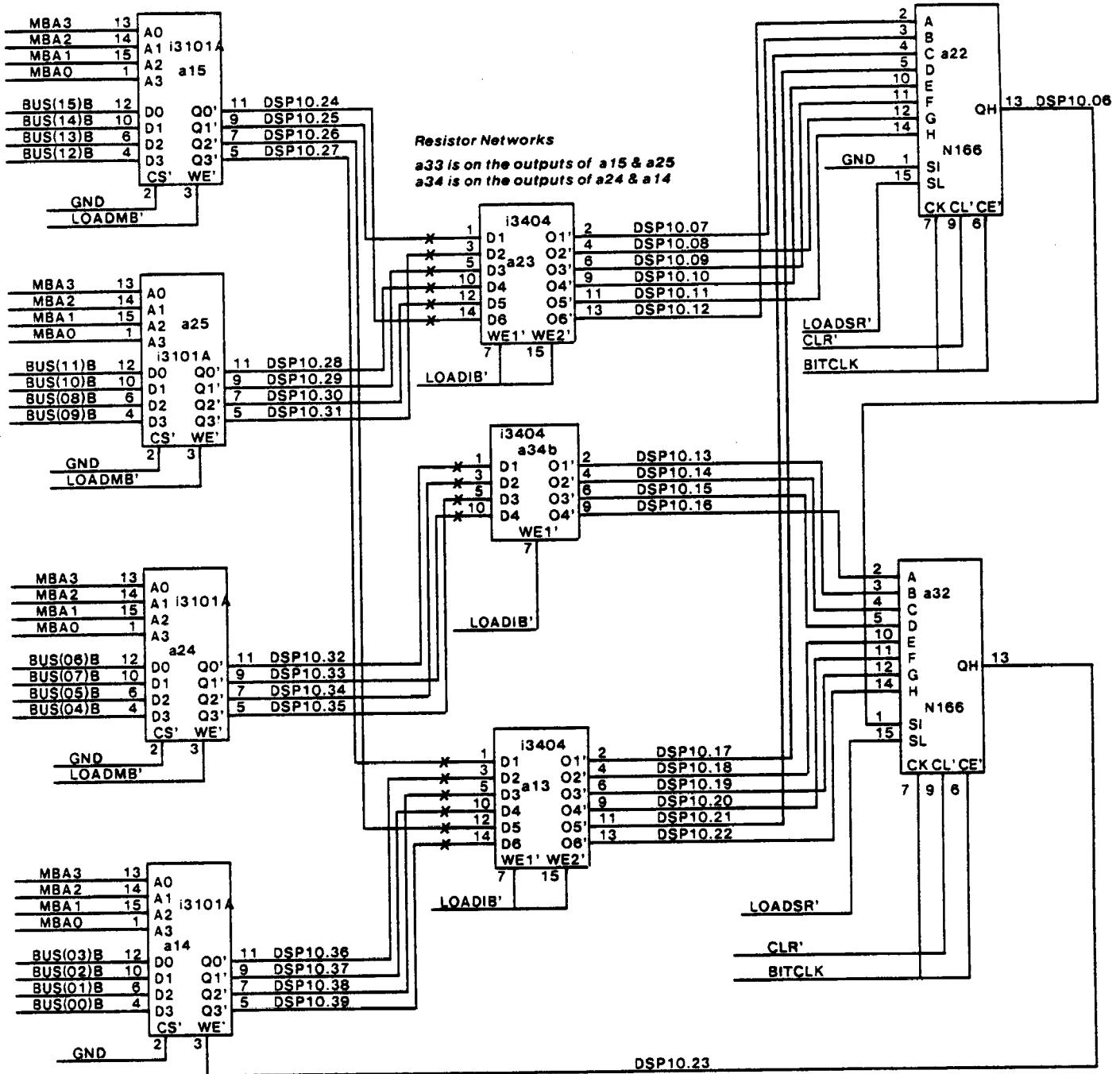


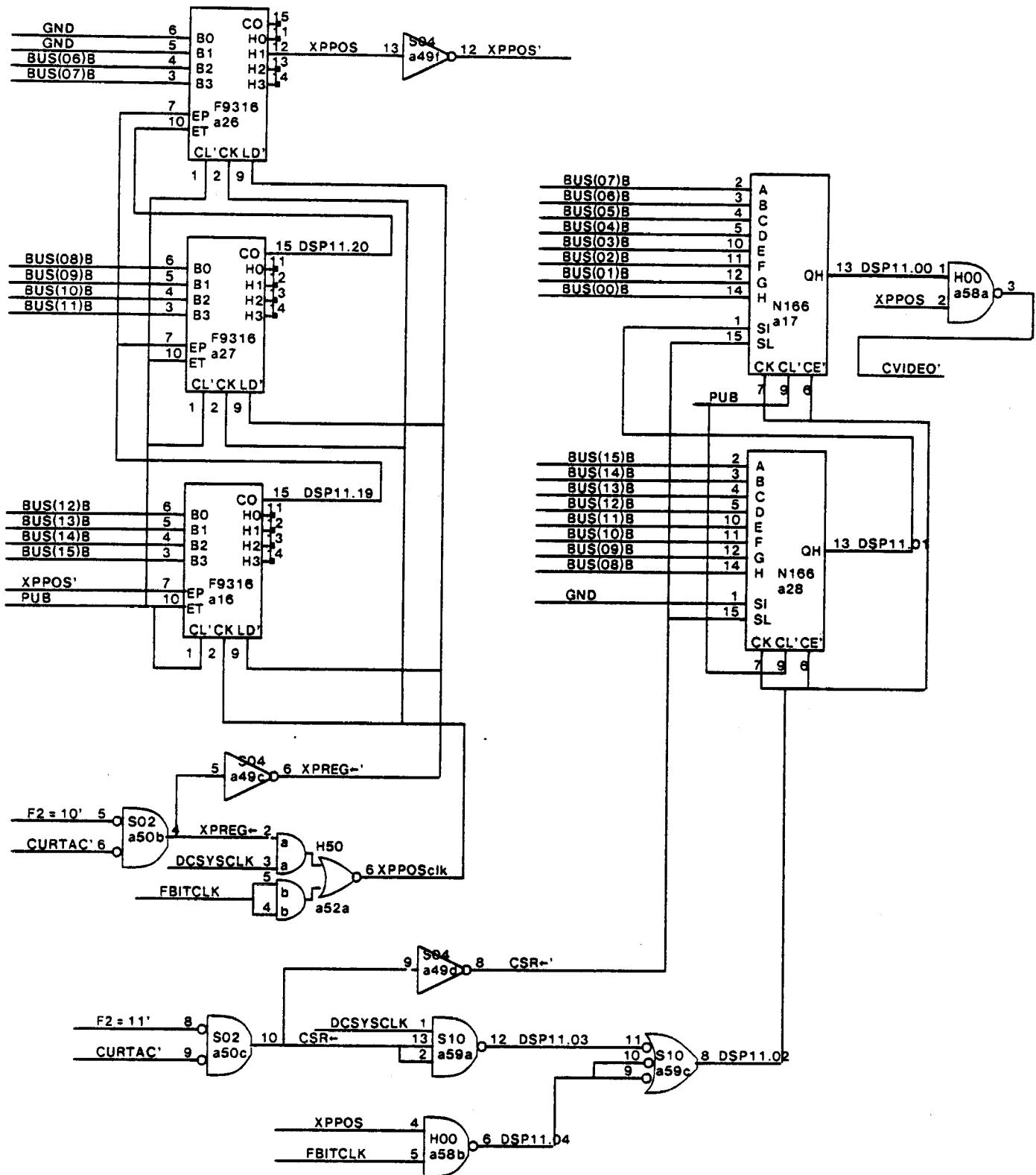
Buffer Control



Video Bit Clock

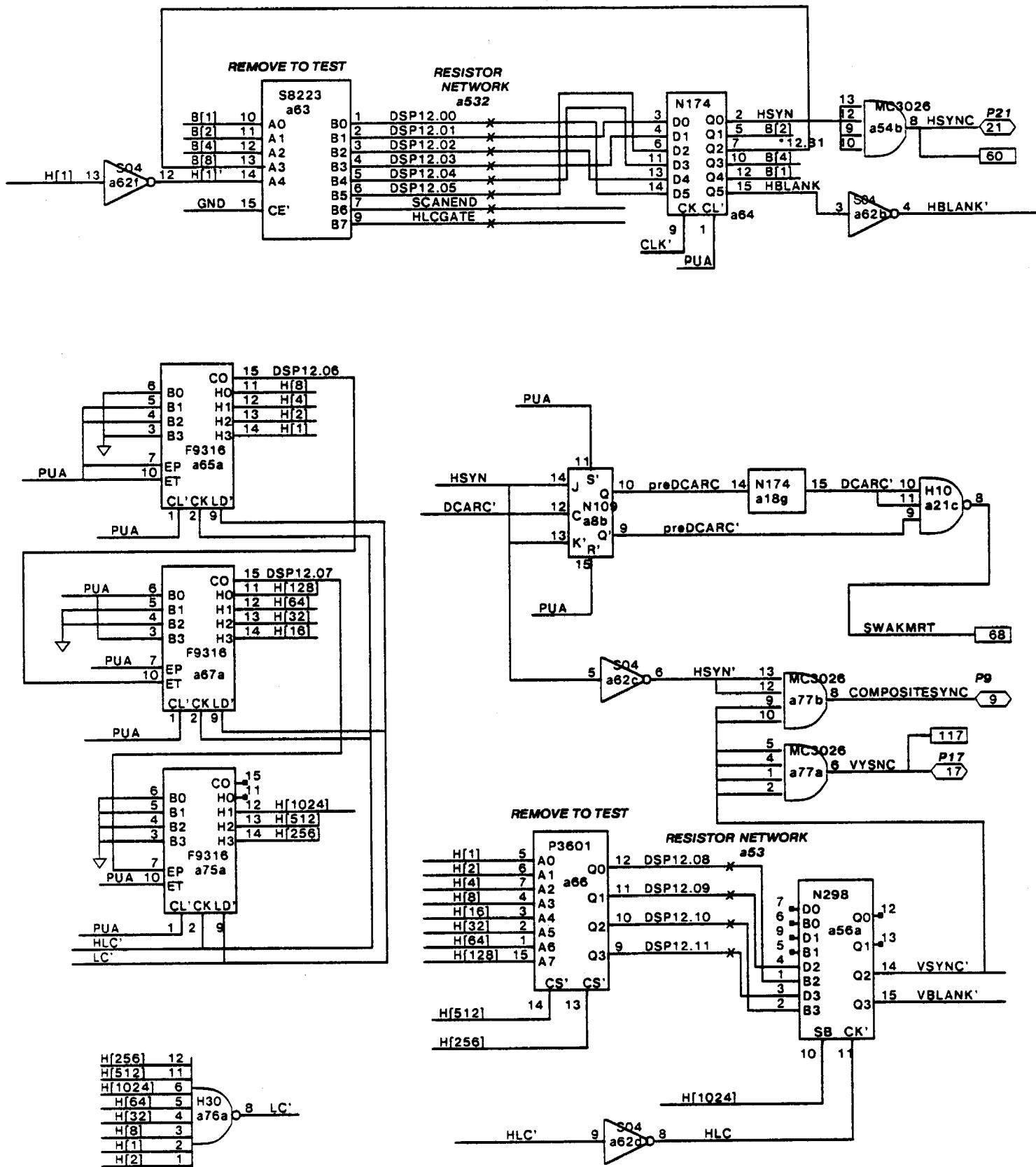
XEROX SPG	Project ALTO2	ASSEMBLY, P.W... DISPLAY CONTROL	File DISPLAY.SIL-9	Designer FREEMAN	Rev G	Date 11/11/80	Page 9
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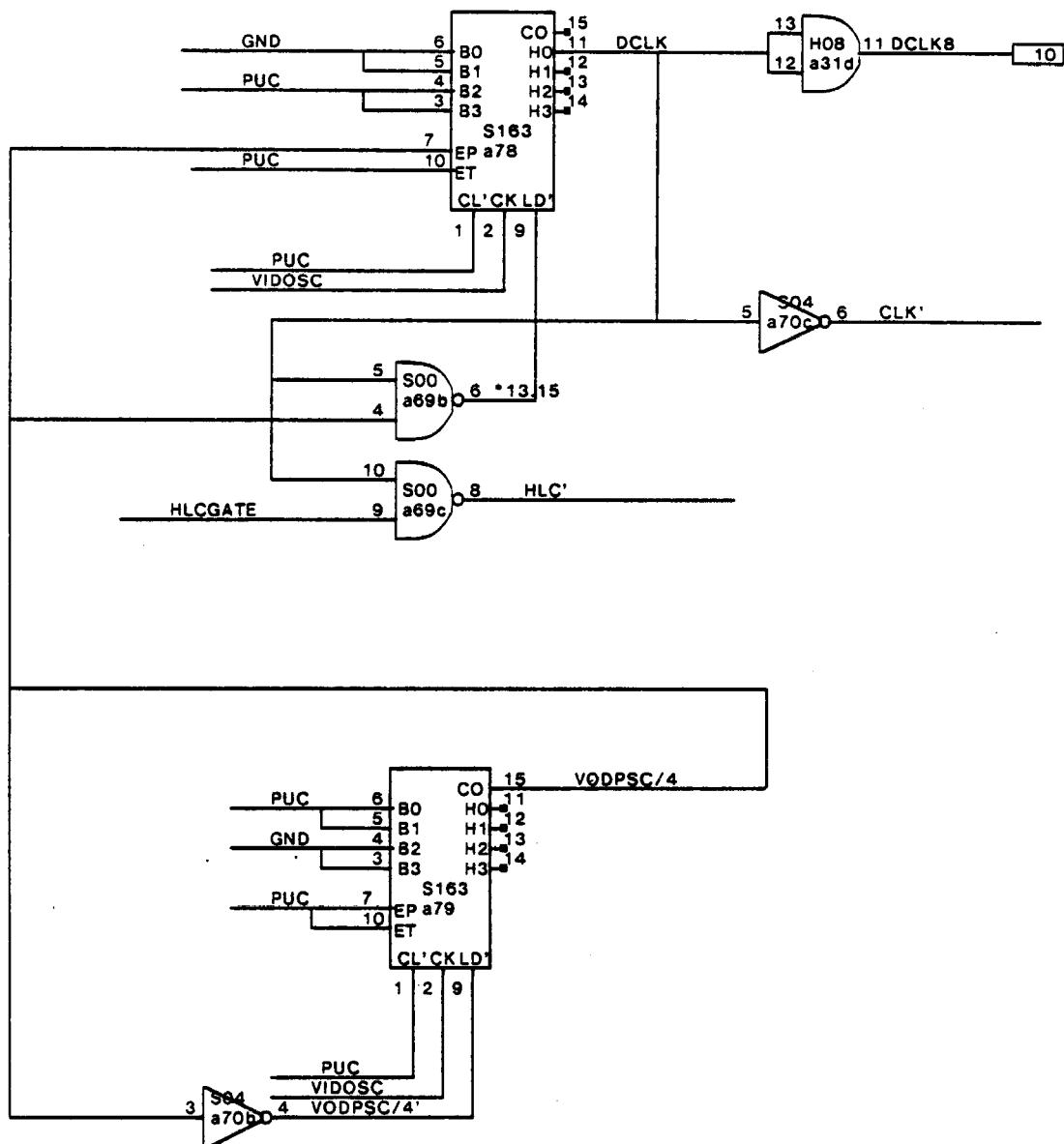
CURSOR

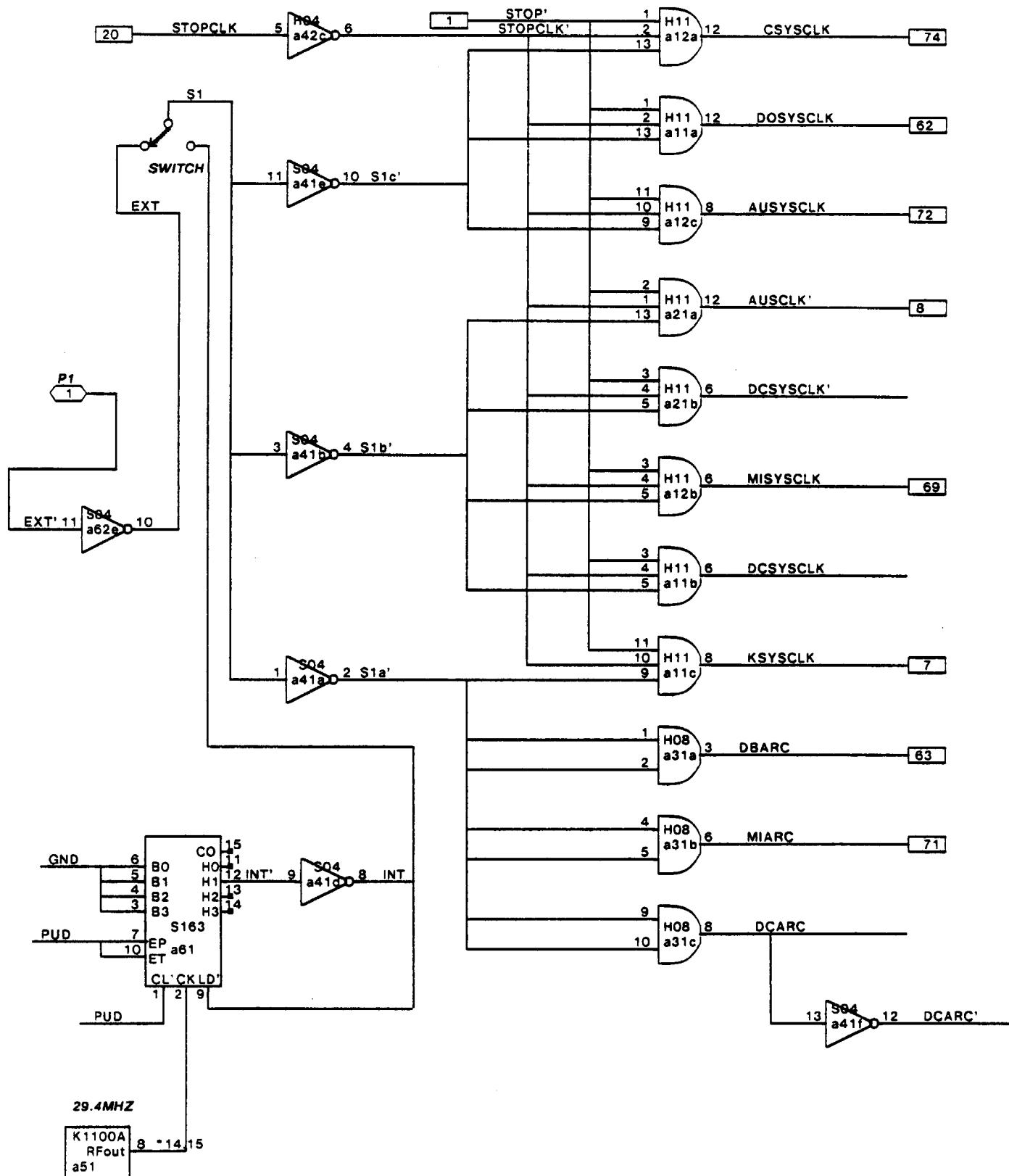
XEROX SPG	Project ALTO2	ASSEMBLY, P.W... DISPLAY CONTROL	File DISPLAY.SIL.	Designer 1 FREEMAN	Rev G	Date 11/11/80	Page 11
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**SYNC GENERATOR  
875 LINE**

XEROX SPG	Project ALTO2	ASSEMBLY, P.W... DISPLAY CONTROL	File DISPLAY.SIL-12	Designer FREELMAN	Rev G	Date 11/11/80	Page 12
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### SYSTEM CLOCKS

XEROX SPG	Project ALTO2	ASSEMBLY P.W. DISPLAY CONTROL	File DISPLAY.SIL	Designer 4 FREEMAN	Rev G	Date 11/11/80	Page 14
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Wire No.	Term	From	To	Term	Wire Type	Notes	Signal	Chg. Let.
1		J2 - 13	J1 - 1			3		
2		25	2					
3		12	3					
4		24	4					
5		11	5					
6		23	6					
7		10	7					
8		22	8					
9		9	9					
10		21	10					
11		8	11					
12		20	12					
13		7	13					
14		—	14					
15		19	15					
16		6	16					
17		18	17					
18		5	18					
19		17	19					
20		4	20					
21		16	21					
22		3	22					
23		15	23					
24		2	24					
25		14	25					
26		J2 - 1	J1 - 26			3		

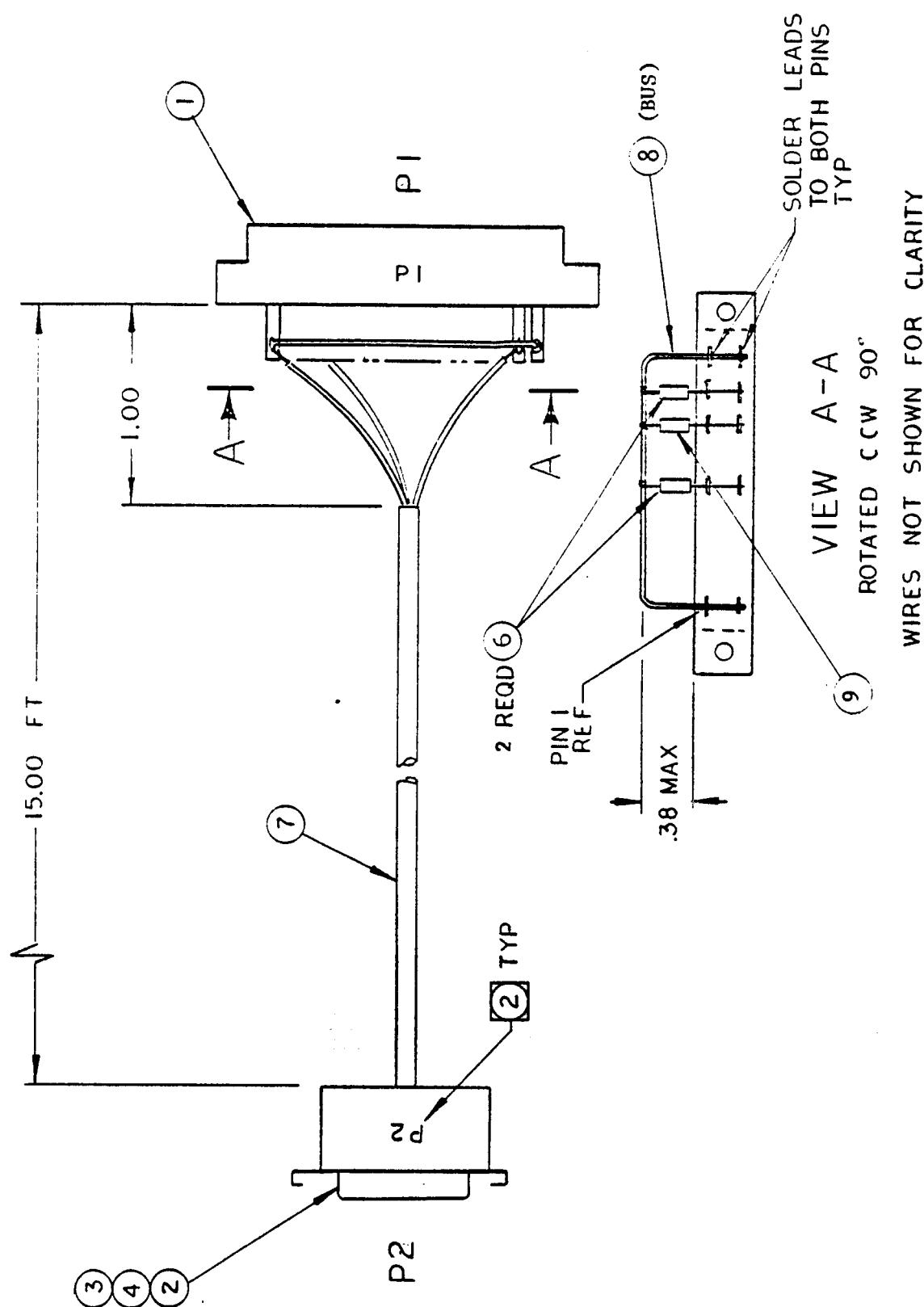
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1. Ref Item No's in Applicable Material List.
2. Ref Designations Are Abbreviated. Prefix Each Designation With:

ALTO II  
ASSEMBLY, CABLE -  
DISPLAY (INTERNAL)

Xerox Corporation  
El Segundo, California  
216412

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Title

ALTO 11

Xerox Corporation  
El Segundo, California

**XEROX**

D

216410

3 01 5



NOTES: UNLESS OTHERWISE SPECIFIED

1. ASSEMBLE PER MODULE ASSEMBLY SPEC, DWG NO. 216207.
- 2 MAY BE PURCHASED FROM STANDARD WIRE & CABLE COMPANY, EL SEGUNDO, CALIFORNIA. VENDOR PART NO.
- 3 MAY BE PURCHASED FROM CTS CORPORATION, ELKHART, INDIANA. VENDOR PART NUMBER US104L.
- 4 MAY BE PURCHASED FROM ROGAN CORPORATION, NORTHBROOK, ILLINOIS. VENDOR PART NUMBER SC-10, BLACK, .140" x .093".
- 5 AFTER SOLDERING, TRIM "R1" RESISTOR LEADS ON ETCH SIDE AS CLOSE TO THE PRINTED WIRING BOARD AS POSSIBLE AND ADHERE APPROX 1.0" LENGTH OF TEFLON TAPE (ITEM 11) OVER TRIMMED LEADS.
- 6 TAG LOOSE ENDS OF CABLE AS TO THEIR DESTINATIONS PER WIRE LIST.
- 7 INSTALL ITEM 4 TO ITEM 3 USING SUITABLE ADHESIVE.

WIRE LIST

WIRE NO.	FROM	TO	6	WIRE TYPE	NOTES
1	PWB - 1	J1 - PIN C	6	9	YELLOW
2	PWB - 2	J1 - PIN D	6	8	BLUE
3	PWB - 3	J1 - PIN B	6	7	ORANGE

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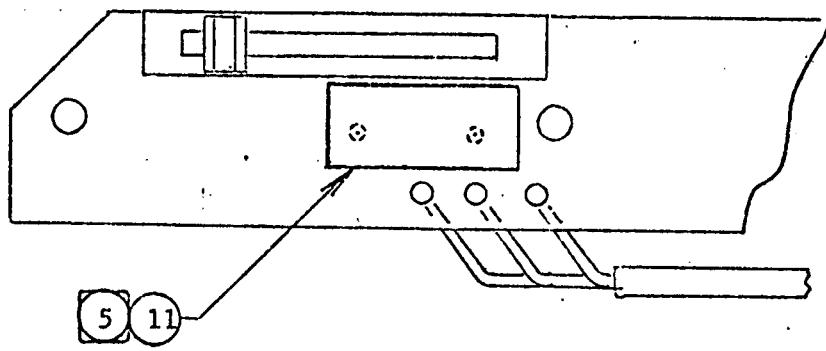
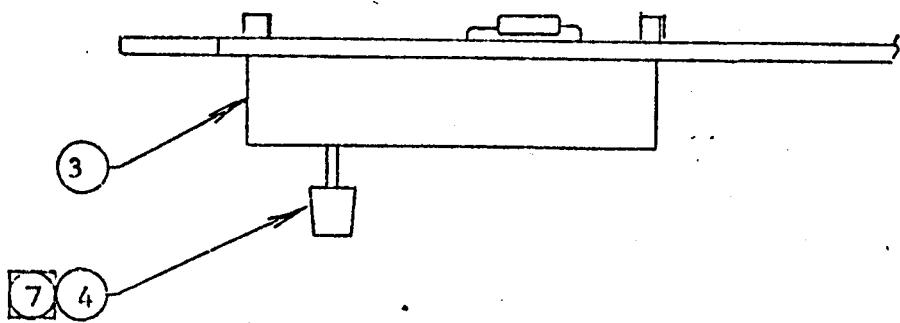
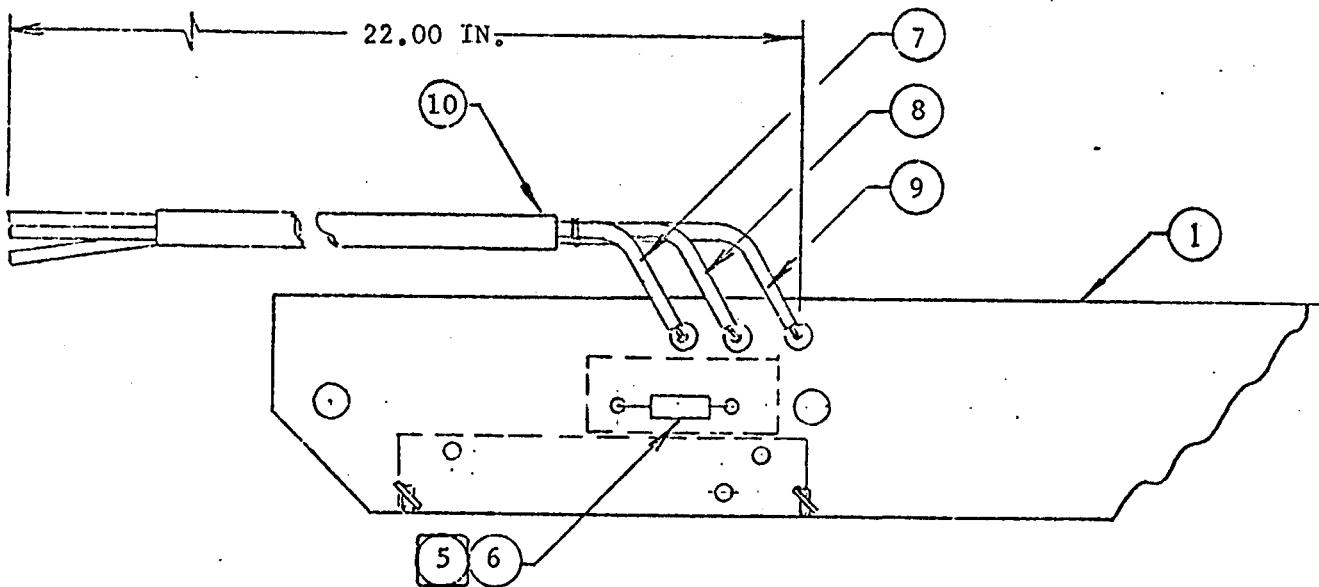
Title  
ASSEMBLY, PRINTED WIRING  
DISPLAY INTENSITY CONT.

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XEROX

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Title  
ASSY, PRINTED WIRING-  
DISPLAY INTENSITY  
CONTROL

Xerox Corporation  
El Segundo, California

**XEROX**

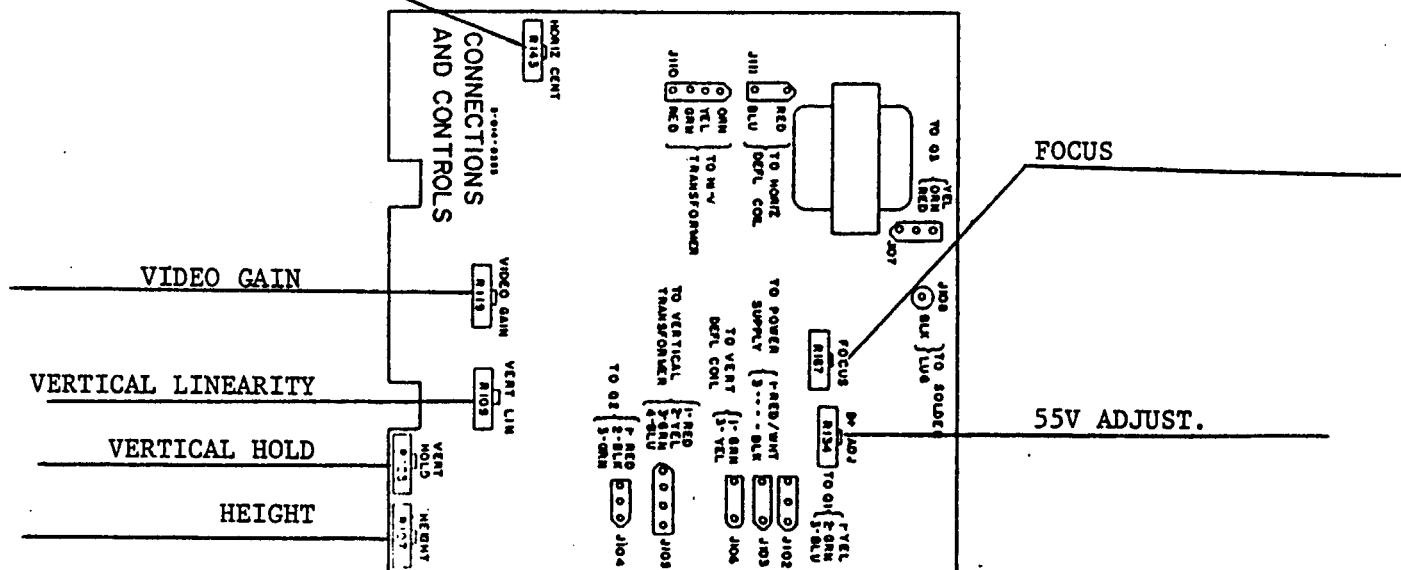
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## DISPLAY ADJUSTMENTS

HORIZONTAL CENTERING



DISPLAY ASSEMBLY PCB

AS VIEWED FROM FRONT

OF DISPLAY